A NEW SPECIES OF *AGALINIS* (SCROPHULARIACEAE) FROM GRIMES COUNTY, TEXAS

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ABSTRACT

Agalinis navasotensis Dubrule & Canne-Hilliker is described from a sandstone outcrop in Grimes County, Texas. It is morphologically most similar to the Louisiana species, *A. caddoensis* Penn., from which it differs primarily in characters of the inflorescence, calyx, and corolla. The plant and its unusual habitat are described. A table and a key are provided to distinguish *A. navasotensis* from similar *Agalinis* of Texas and neighboring areas.

RESUMEN

Se describe *Agalinis navasotensis* Dubrule & Canne-Hilliker que crece en afloramientos de areniscas en el Condado Grimes, Texas. Morfológicamente es muy similar a *A. caddoensis* Penn. de Louisiana, de la cual se diferencia principalmente por caracteres de la inflorescencia, cáliz y corola. Se describen la planta y su habitat particular. Se incluyen un cuadro y una clave para distinguir *A. navasotensis* de las especies parecidas de *Agalinis* de Texas y de áreas cercanas.

INTRODUCTION

The genus *Agalinis* comprises some 40 species in temperate America and is the largest and most complex genus of the Scrophulariaceae in the eastern United States (Holmgren 1986; Mabberly 1987). The *Manual of the Vascular Plants of Texas* (Correll & Johnston 1970) lists 15 species for Texas. Checklists updating the manual list the same number (Johnston 1988) or bring the number to 17 with the inclusion of species treated by the manual under *Tomanthera* Raf. (Hatch, et al. 1990).

During preparation of a treatment of the Scrophulariaceae of Brazos County, TX and surrounding counties, a specimen (*Ajilvsgi 8510*) was found at TAMU with a determination of *A. viridis* but which could not be keyed to any known Texas species of *Agalinis*. The location cited was a familiar rock outcrop in Grimes

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SIDA 15(3): 425 – 440. 1993

County and a visit to the outcrop revealed a population of plants with the same morphology as the Ajilvsgi specimen. These plants, also, could not be identified as belonging to any species listed for Texas. The possibility that the plants were edaphic variants of some known species was considered. However, plants grown in hydroponic culture from seeds taken from outcrop plants exhibited the same characteristics as those at the collection site.

Subsequent seasons of field work, laboratory investigations, and herbarium study, including examination of type specimens, have convinced us that the Grimes County plants represent a new species of *Agalinis*, hereafter treated under the name *A. navasotensis* Dubrule & Canne-Hilliker.

Agalinis navasotensis Dubrule & Canne-Hilliker, sp. nov. (Figs. 1–7)

Agalinis caddoensis similis sed plantis tenuioribus atque foliis caulium usque 4 cm longis valde recurvatisque; tubo calycis obconico vel infundibulari 2.6–3.7 mm longo; corolla (13)16–21(27) mm longa; thecis antherarum adaxialum in filamentis oblique collocatis et saepe 1–2 appendicibus apicalis sterilibus. In solis non profundis lapis arenariis expositis endemicis.

Similar to *Agalinis caddoensis* but the plant finer and with stem leaves to 4 cm long and often sharply recurved; calyx tube obconic to funnelform, 2.6–3.7 mm long, corolla (13)16–21(27) mm long; thecae of adaxial anthers obliquely placed on the filament and often with 1 or 2 sterile apical appendages; endemic to sandstone outcrops in shallow soil.

DESCRIPTION

Annual herb from a few fibrous roots, 2.8–9.0 dm tall, often tinged with purple, maroon, or bronze, *darkening little if at all on drying* if promptly pressed. Stem erect or sometimes declined, single from the base, divaricately branched above, terete to slightly angled below the branches, quadrangular-striate above, minutely scabridulous below and sparsely to moderately so above along the angles and sides. *Axillary fascicles absent*. Leaves opposite, spreading to ascending or often recurved, *filiform*, narrowly U-shaped in cross-section, 0.5–1(1.2) mm broad, 1.2–3(4) cm long, acute to acuminate, minutely scabrous with silicified hairs on adaxial surface and midvein below, margins silicified and scabrous. Inflorescence racemose or more commonly *paniculate with racemose branches*. Racemes or branches with up to ca. eight floriferous nodes, terminated by leaves or bracts, *no flowers appearing terminal*, flowers solitary or paired at the nodes; if paired, one usually blooming much later than the other. Pedicels slender, terete, spreading or ascending, glabrous to minutely scabridulous with silicified 1- or 2-celled hairs, at anthesis (6)8–21 mm long, usually longer than 10 mm and always longer than the calyx, elongating to ca. 2.5 cm in fruit. Calyx at anthesis *obconical to somewhat campanulate or funnelform, straight-sided*, often appearing truncate with minute teeth; tube 2.2–3.7 mm long, 3–4.4 mm broad, unribbed, exterior glabrous, interior with a narrow band of capitate hairs below the sinuses and lobes;

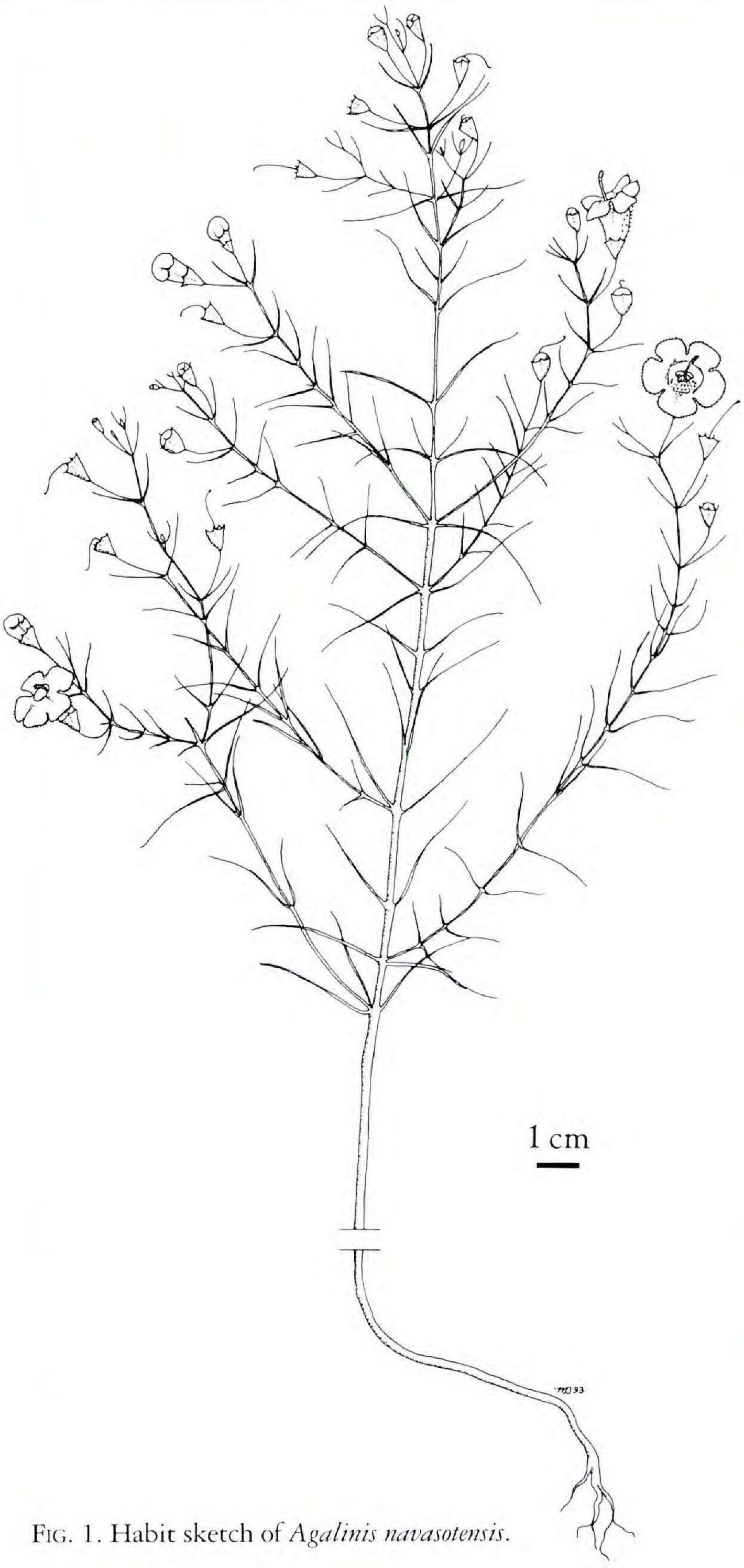


FIG. 1. Habit sketch of *Agalinis navasotensis*.

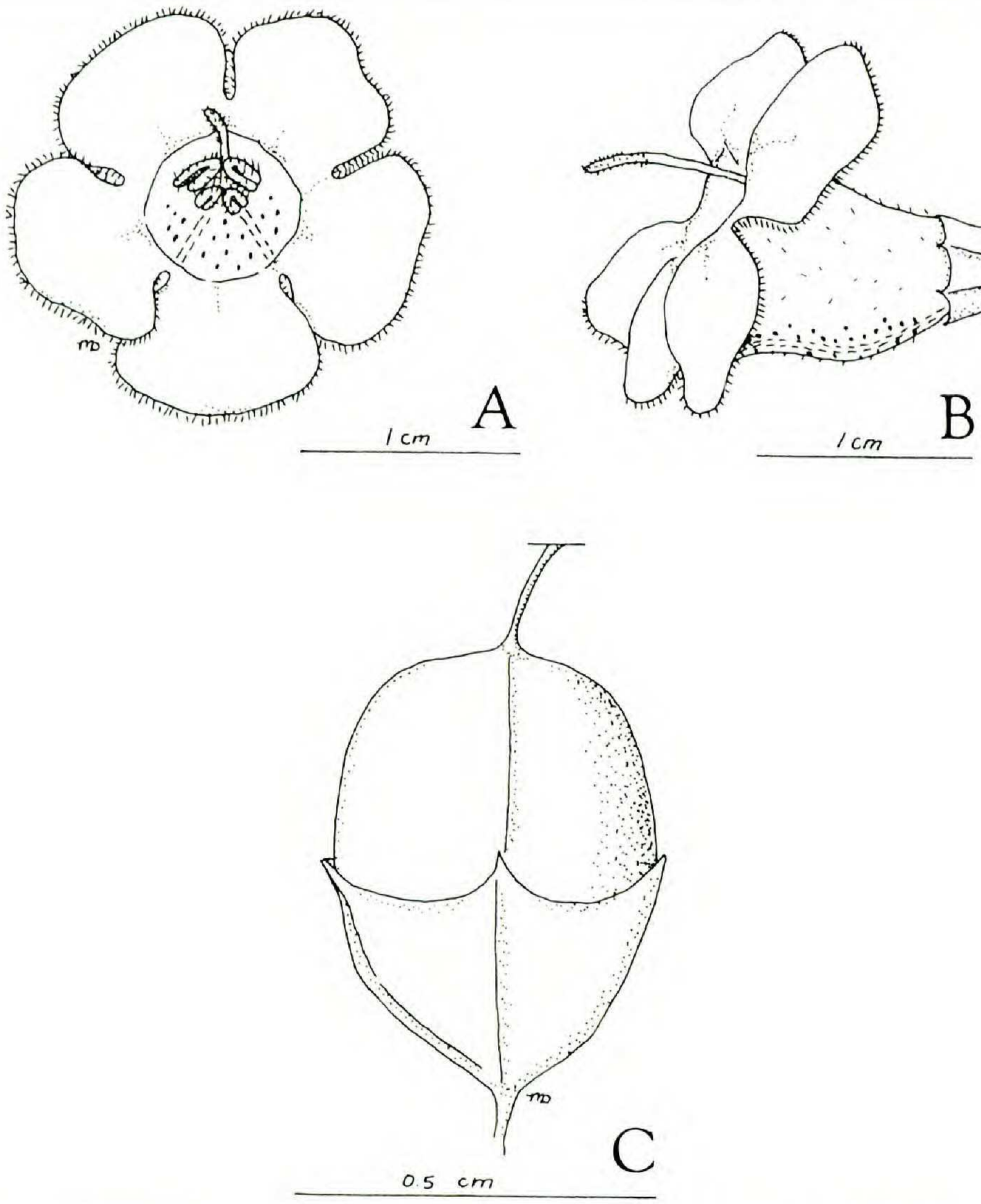


FIG. 2. *Agalinis navasotensis*. A. Corolla, front view; B. Corolla, side view; C. Capsule with persistent calyx.

lobes triangular-subulate, 0.5–1.5 mm long, acute, puberulent within with white silicified hairs, sinuses broad and straight to slightly concave. Relatively larger- and smaller-flowered plants present, but corolla size not correlating with position on the outcrop or size of the plant. Corolla including lobes (13)16–25(27) mm long, lavender- to rose-purple, paler in the larger blossoms and darker in the smaller, throat paler than lobes, with darker spots and two pale yellow lines abaxially; tube 2–3.5 mm long, narrow, glabrous; throat upcurved, the lower side slightly gibbous, *pilose externally* and within in a short, narrow longitudinal band just below the sinus of the adaxial lobes and in a narrow horizontal band among the filament bases; *lobes all spreading or spreading-reflexed, subequal or the lower lobes the longest*, ca. 6–9 mm long, ca. 0.5–2.5 mm longer than the upper, all glabrous except for the densely ciliate margins. Stamens 4, didynamous, abaxial filaments 9–11 mm long, villous; adaxial filaments 5–6 mm long, sparingly villous.

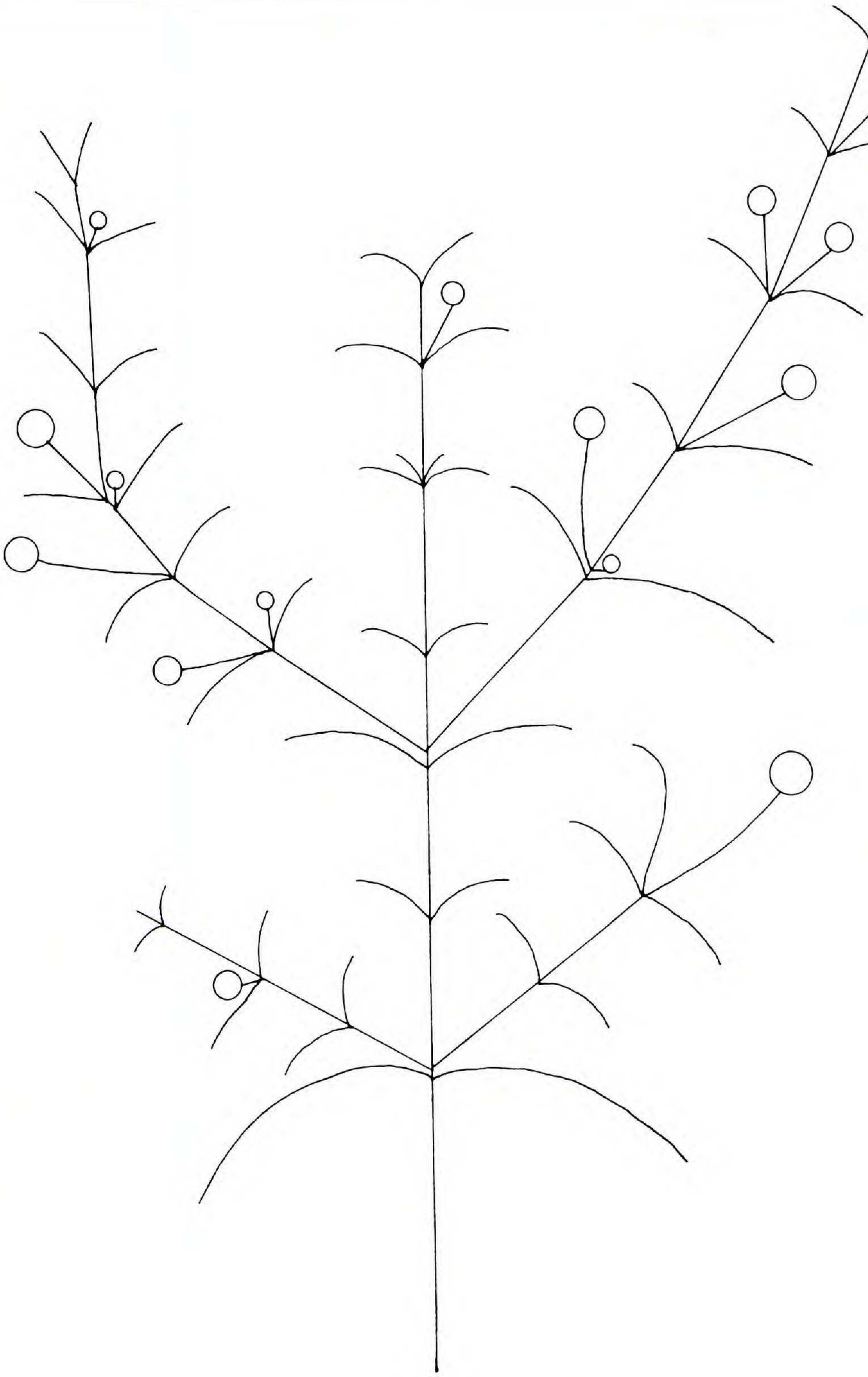
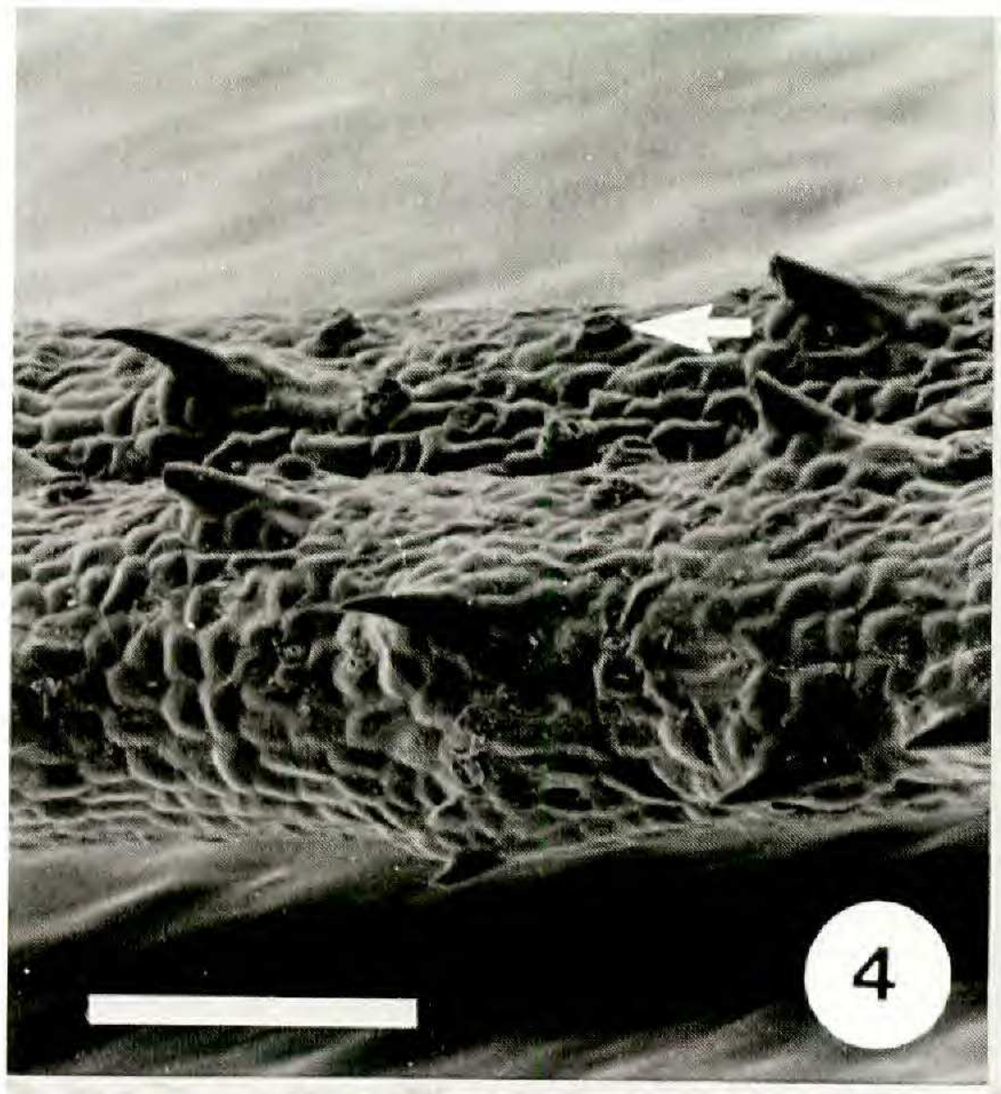
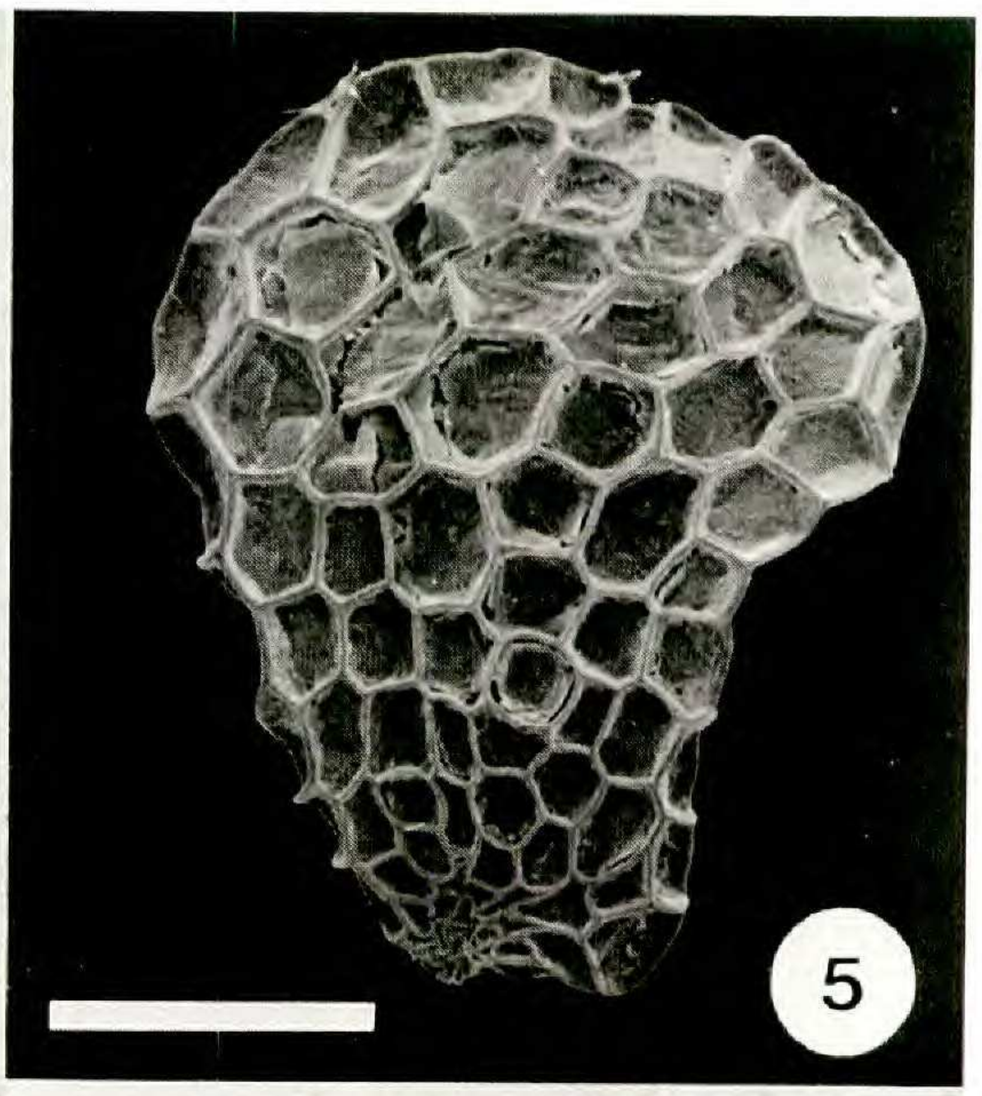
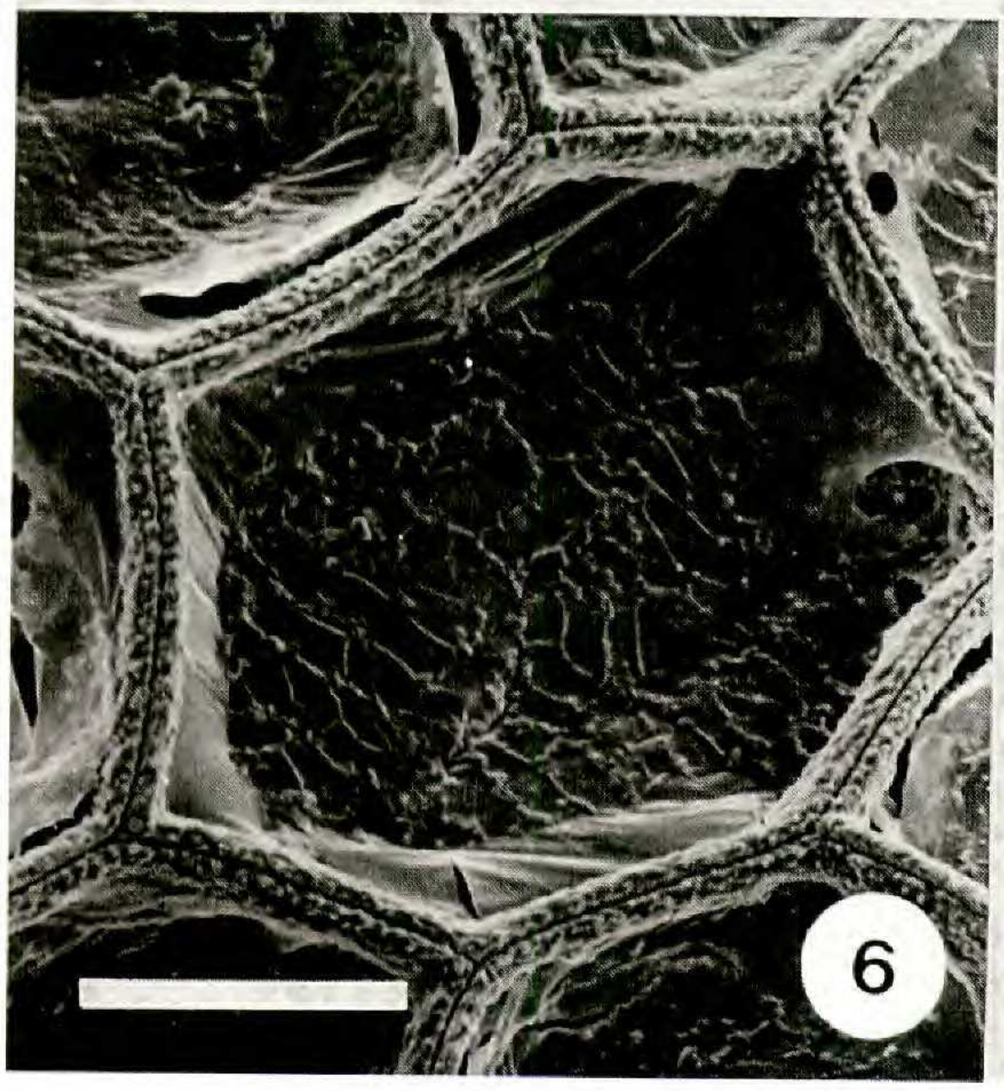
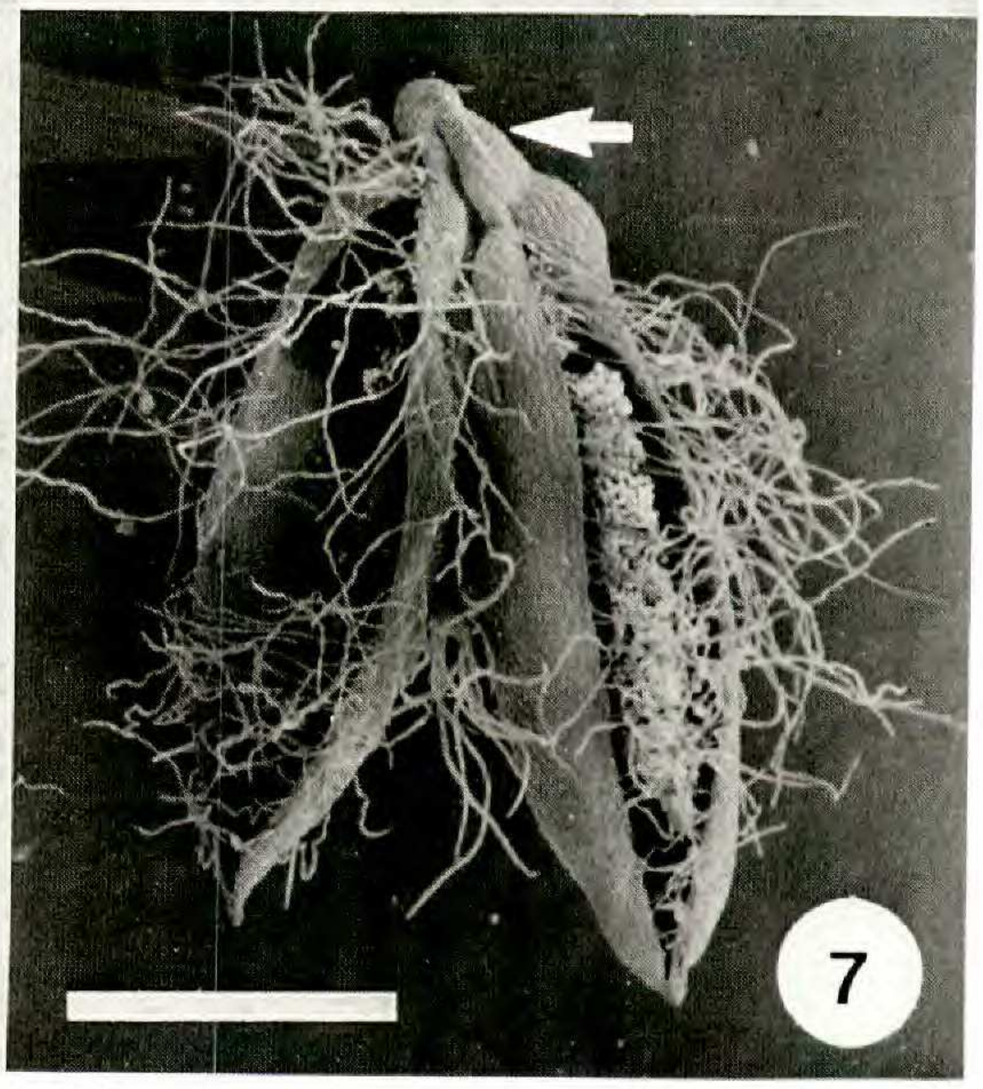


FIG. 3. Diagram of a portion of a well-developed inflorescence of *Agalinis navasotensis*. Circle size is proportional to age of flower.









FIGS. 4–7. Scanning electron micrographs of leaf, seed, and anther of *Agalinis navasotensis*. 4. Adaxial surface of leaf with sessile (arrow) and ornithorhynchous trichomes. Scale bar = 250 µm. 5. Seed. Scale bar = 0.5 mm. 6. Testal cell of seed showing outer tangential wall collapsed onto thickenings on the inner tangential. Scale bar = 75 µm. 7. Adaxial anther showing obliquely positioned thecae and sterile apical appendage (arrow). Most hairs were removed to reveal form of thecae. Scale bar = 1.2 mm.

Anthers of abaxial stamens usually coherent by entangled hairs; thecae villous, 2–3.2 mm long, *those of adaxial anthers placed one slightly above the other on the filament and with 1 or 2 terminal sterile appendages to 0.5 mm long, also with a basal mucro to 0.3 mm long*. Style to 1.5 cm long, pubescent; stigma 2–4.5 mm long, densely yellow-papillate. Capsule 4–7 mm long, conspicuously longer than the calyx, 4–4.5 mm broad, ovoid-or obovoid-oblong. Seeds 0.8–2.3 mm long, dark brown, irregularly trapezoidal, testa reticulate, radial walls of reticulae densely spinulose-

thickened, inner tangential walls with an irregular pattern of spinulose thickenings. Pollen spherical when wet, 6–6.8 μ in diam., ellipsoid when dry, stainability greater than 90%. Chromosome number $2n = 26$.

TYPE: TEXAS. **Grimes Co.:** outcrop on FM 3090, 0.2 mi NE jct FM 3455, NE of Navasota, sand-limestone outcrop, full sun, thin soil, 28 Sep 1992, *Dubrule 1062-D* (HOLOTYPE: TAMU; ISOTYPES: to be distributed to ASTC, BRIT, LSU, MO, NLU, NY, OAC, PH, SBSC, TAES, and TEX.

MATERIALS AND METHODS

Preparation of field collected samples for observation by SEM, and paraplast embedding and sectioning of stems and leaves follow procedures in Canne-Hilliker and Kampny 1991. Chromosome counts of mitotic cells were made from root tips excised from seedlings grown in petri plates and from plants grown in hydroponics. Pretreatment and staining procedures are given in Canne 1981. Type specimens of all species of *Agalinis* discussed herein have been examined by JMC-H. Seedling morphology was observed on 50 plants in which the first pair of cauline leaves were less than 3 mm long. Measurements were made with an ocular micrometer on a Wild M8 dissecting microscope. Trichome morphology was observed on seedlings placed in water on depression slides and viewed on a Zeiss standard research microscope. Pollen viability was estimated by staining pollen with lactophenol cotton blue.

RESULTS AND DISCUSSION

Agalinis navasotensis is placed in section *Purpureae* subsection *Pedunculares*. As delimited by Pennell (1929, 1935) and realigned by later workers (Canne 1979, 1981, 1983, 1984; Canne-Hilliker and Kampny 1991), this subsection includes *A. peduncularis* (Benth.) Pennell, *A. gypsophila* B. L. Turner, *A. pulchella* Pennell, *A. caddoensis* Pennell, *A. edwardsiana* Pennell, *A. homalantha* Pennell, *A. strictifolia* (Benth.) Pennell, and perhaps *A. aspera* (Benth.) Britton. These are annual plants (with the exception of *A. gypsophila*) with linear to filiform, usually scabrous leaves, pedicels usually 2–4 times longer than the subtending bracts and always longer than the calyx at anthesis, calyx lobes triangular-subulate and much shorter than the calyx tube, corollas ca. 2–3 cm long, capsules globose to ovoid or oblong, and seeds brown with a loosely adherent, reticulate seed coat. *Agalinis peduncularis* and *A. gypsophila* are Mexican species; the others are found in the central and southeastern U.S.

The leaves of *Agalinis navasotensis* are filiform and narrowly U-shaped at mid-blade in transverse section. Phloem fibers and xylem sclereids are absent from the massive midvein. The mesophyll consists of 3–4 cell layers of palisade parenchyma and 5–7 cell layers of spongy parenchyma. At the leaf margins and on abaxial epidermal cells overlying the mid-vein the outer tangential and radial cell walls are silicified. Leaves are amphistomatic. The leaves of *A. navasotensis* bear

sessile, anvil, ornithorhynchous, and obtuse trichomes (Fig. 4) typical of most other species of *Agalinis* (Canne-Hilliker and Kampny 1991). Leaf anatomy is consistent with that known for other members of subsect. *Pedunculares* (Canne-Hilliker and Kampny 1991). The filiform leaves are morphologically most similar to those of *A. caddoensis*. Other species in the subsection have linear to broadly linear leaves. The stem anatomy is like that recently reported for other members of the subsection (Canne-Hilliker and Kampny 1991).

The seedlings of *A. navasotensis* have oblong cotyledons 1.8–2.5 mm long, making them the largest cotyledons recorded among the 19 species of *Agalinis* for which seedling data are known (Canne 1983). The trichome complement is distinctive as well. Acute trichomes similar to those on the cotyledons of related *A. pulchella* and *A. strictifolia* (but not *A. edwardsiana*) are present, as are the dome-shaped trichomes present on cotyledons of all examined species. Cotyledons of *A. navasotensis*, like those of *A. edwardsiana*, lack the capitate trichomes found in *A. pulchella* and *A. strictifolia*.

The seeds of *A. navasotensis* vary in shape and size dependent upon position within the capsule (Fig. 5). They are morphologically similar to seeds of related species in subsect. *Pedunculares* (Canne 1979) but differ in details of testal cell shape as well as ornamentation of the radial cell walls and the pattern of thickenings on the inner tangential walls. The latter thickenings are slender, sparingly spinulose, and form a pattern of small polygons and circles (Fig. 6).

All of the numerous individuals of *A. navasotensis* examined show a mitotic chromosome number of $2n = 26$. This is consistent with previously reported counts for *A. edwardsiana*, *A. pulchella*, *A. strictifolia* (Canne 1981, 1984) and *A. aspera* (Löve and Löve 1982).

Agalinis navasotensis differs from all other members of the section in several respects (Table 1, Appendix 1). The plants tend not to darken upon drying. Such discoloration is characteristic of most other *Agalinis* and of many other Scrophulariaceae as well. Sterile terminal appendages occur on the thecae of the adaxial anthers in several species of subsect. *Pedunculares* but no others have the offset placement of thecae seen in *A. navasotensis* (Fig. 7). As noted above, the micromorphology of the seed coat is distinctive (Fig. 6), as with most species of the subsection (Canne 1979). Neither capsules nor seeds are present on any of the specimens of *A. caddoensis*. Because extant populations of this species are not known, fruit and seed data are lacking. We have not seen seeds of *A. gypsophila*.

The inflorescence of *A. navasotensis* is also distinctive. All species in the subsection except *A. pulchella*, *A. caddoensis*, and *A. navasotensis* produce well-developed racemes with 4 to 10 nodes. Most species produce only one flower on at least some of the nodes. The short racemes of *A. pulchella* and *A. caddoensis* often have uppermost flowers that appear terminal. Branching within racemes is uncommon except in *A. strictifolia* which has numerous short, lateral branches

with often secund flowers, and in *A. navasotensis* in which racemes are short and often interrupted by short, flowering, lateral branches. Uppermost flowers in this species do not appear terminal. Figure 3 illustrates a portion of the "paniculate" inflorescence of *A. navasotensis*.

Agalinis navasotensis most closely resembles (and in most treatments will key to) *A. caddoensis*, a plant of northwestern Louisiana not seen alive since its first collection by F.W. Pennell in 1913. MacRoberts (1978) reduced *A. caddoensis* to a synonym of *A. strictifolia* (Benth.) Penn., but it clearly does not belong to this species (see Table 1 and Appendix 1) and most authors since have maintained it as a separate species (e.g., Vincent 1982). *Agalinis navasotensis* may be distinguished from *A. caddoensis* on the following basis: plants more delicate, the primary stem leaves often longer and recurved; inflorescences racemose-paniculate and not solely racemose; calyx obconic and not hemispheric; flowers smaller; anthers smaller and the thecae of the adaxial pair obliquely offset.

The features separating *A. navasotensis* from the Texas species of subsection *Pedunculares* and from other narrow-leaved, long-pediceled *Agalinis* from Texas are summarized in Table 1. Appendix 1 provides a dichotomous key to the narrow-leaved, long-pediceled *Agalinis* of Texas and to other species of subsect. *Pedunculares*.

HABITAT INFORMATION

Agalinis navasotensis is presently known from only one population ca. 3.2 miles northeast of Navasota in Grimes County in east-central TX. An estimated 100 to 200 individuals are growing in full sun on a southeast-facing rock outcrop, immediately adjacent to FM 3090. Keeney (1967) conducted a survey of the flora and geology of the site. The substrate is a sandstone representing the easternmost escarpment of the Miocene Oakville formation. It was laid down as layers of alluvium washed from Cretaceous outcrops and contains large amounts of shell and foraminifera sediments. The soil is shallow and sandy. Keeney (1967) determined the pH to range from 7.4–7.6. Keeney reported that at the time of his work, the area had never been cultivated and had not been grazed since 1958; neither is it currently being cultivated or grazed.

The outcrop represents a distinct floral unit—an "island" in the surrounding "sea" of Post Oak Savannah, Blackland Prairie, and farmland of the Navasota River valley. Table 2 presents a partial taxon list for the site. Many of the plants listed are largely confined to calcareous soils or outcrops and are more typical of the Edwards Plateau region or calcareous regions of South Central Texas. For example, the outcrops near Navasota are the only sites known in Grimes County for *Lesquerella densiflora*, *Coryphantha missouriensis*, and *Lygodesmia texana*.

This habitat differs greatly from that of the type location for *Agalinis caddoensis*, which was described as a dry loam oak wood along Kansas City Southern

TABLE 1. Comparison of *Agalinis navasotensis* with similar taxa.

TAXON	A.F.[1]	LEAVES[2]	INFLORESCENCE	PEDICEL[3]	CALYX[4]
A. gattingeri *n*=13	-	linear 20–30 × 1.2	raceme, 1–5 flrs 1/node, upper look terminal	2–30 filiform	campanulate, 2.5–3.5
A. viridis	-	linear, erect-ascending, flat to sl. revolute 15–28 × 1.3	raceme, 2–15 flrs (1)2/node, upper look terminal	2–22 ascending	obovoid-campanulate, 3.5–4
A. pulchella *n*=13	+	linear-subfilif. spreading 20–30 × 0.4–1.0	raceme, 4–6 flrs 1–2/node, upper may look terminal	11–30 ascending-spreading	hemispheric, 3–4
A. strictifolia *n*=13	-	linear, spread-reflexed; on fl. branches appressed 20–35 × 1.0–3.0	raceme, 4–10 flrs 1–2/node	10–25 ascending-spreading	campanulate-hemispheric, 3–4
A. homalantha	+	linear, revolute 20–40 × 0.7–1.5	long raceme, 3–10 flrs, upper flrs may look terminal	(6)10–33 ascending-spreading	campanulate-hemispheric, 3–4
A. edwardsiana *n*=13	-	linear 20–35 × 0.5–0.9	+/- long raceme, 2–9 flrs	30+ ascending-spreading	hemisphic, 3.5–4.5
A. tenuifolia *n*=14	-(+)	linear, flat to ~revolute, spreading 20–50(100) × 1–6	elongate raceme, 2–23 flrs 2/node	(4)7–30 arched-ascending	campanulate-hemispheric, 2–4
A. caddoensis	-	filiform, U-shape 20–33 × 0.8	interrupted rac. 1–5 flrs, many look terminal	(5)10–22 ascending-spreading	hemispheric-campanulate, (3)3.5–5.5
A. navasotensis *n*=13	-	filiform, U-shape recurved or upcurved 12–30(40) × 0.5–1.0(1.2)	racemose-panicle to ~8 flrs, 1–2/node (diff. times) few if any look terminal	(6)8–21 ascending-spreading	obconic, 2.2–3.7

[1]presence (+) or absence (-) axillary fascicles; [2]leaf shape and l × w in mm; [3]pedicel length in mm and orientation; [4]calyx shape and length in mm

CA LOBES[5]	COROLLA[6]	ANTHERS[7]	STIGMA[8]	FRUIT[9]	HABITAT
Δ to Δ-subulate (0.2)0.5–1.5	12–20, upcurved, lobes equal, spreading	1.3–2 b. awn 0.2–0.5	(1)2–3	globose/ gl-ovoid 4–5	sand-clay slopes, woods
Δ-lance to lanceolate 1.5–2	7–14, upcurved, lobes equal, spreading, 2–4	0.9–1.5 b. mucro 0.1–0.3	1.0–1.3	globose-ovoid (4.5)5–7	sandy-clay, pine & hardwood forest
subulate, recurved to 0.5(0.9)	15–(27)30, upcurved, lobes equal, 9–12	2.5–3.7 b. awn 0.3–0.8	2(3–4)	globose/ gl-ovoid 5–6	sand/clay, grassland, pine or mixed woods
Δ-lance-subulate 1–2	20–25, strongly upcurved, lobes 8–10	———	———	quadrate ca. 6	sandy, open mesquite & scrubland
lance-acum./ Δ-lanceolate Δ-subulate oft. reflexed 0.5–1.2	(14)18–27, straight, posterior lobes forward, 3–4; anterior 8–9	3–4 b. awn 0.5–0.8	1–2(4)	subglobose/ gl-ovoid (4)5–7	sandy/clay, oak or pine woods, fields
Δ-subulate/ subulate-acute 0.5	20–23, straight, posterior lobes forward, 5–6; anterior 8–9	———	———	globose/ gl-obovoid 6–7	thin soil, adobe or lime
wide-Δ to subulate 0.2–1.5(2.3)	7–23, all lobes equal, forward or anterior spreading	1.5–2.3 (3.0)	1–2	globose 3–7(8)	moist or dry clayloam, woods, fields
Δ-subulate 0.7–0.1	20–30, upcurved, lobes equal, 6–7	3–4 b. mucro to 0.3	3–5	———	dry loam oak woods
Δ-subulate 0.5–1.5	(13)16–25(27), upcurved, posterior lobes shorter	2–3.2 b. mucro to 0.3 thecae of short sts. uneven, a. appen. to 0.5	2–4(4.5)	ovoid/ obovoid/ oblong 4–7	calcareous sandstone out-crop, sun

[5]calyx lobe shape and length in mm; [6]corolla length in mm, shape, lobe shape and length in mm; [7]anther length in mm and presence of basal (b.) or apical (a.) appendage and its length in mm; [8]stigma length in mm; [9]fruit shape and length in mm.

TABLE 2. Taxa associated with *Agalinis navasotensis*.

Agalinis heterophylla (Nutt.) Small ex Britt. & A. Br.
Ambrosia trifida L. var. *texana* Scheele
Amphiachyris dracunculoides DC.
Aphanostephus skirrhobasis (DC.) Trel.
Arenaria patula Michx. var. *patula*
Aristolochia erecta L. (*A. longiflora*)
Astragalus nuttallianus DC. var. *austrinus* (Sm.) Shr. & Wigg.
Bifora americana (DC.) Benth. & Hook.
Bouteloua gracilis (Kunth *in* HBK.) Lag. ex Griffiths
Calylophus berlandieri Spach subsp. *berlandieri*
Castilleja indivisa Engelm.
Celtis reticulata Torr.
Chaetopappa asteroides Nutt. ex DC.
Commelina erecta L
Coryphantha missouriensis (Sweet) Britt. & Rose
Croton monanthogynus Michx.
Dactyloctenium aegyptium (L.) Beauv.
Dalea compacta Spreng. var. *compacta*
Dichanthelium sp.
Engelmannia pinnatifida Nutt.
Eragrostis sp.
Erigeron strigosus Muhl. *ex* Willd.
Euphorbia bicolor Engelm. & Gray
Evax verna Raf.
Gaura parviflora Hook.
Hedeoma reverchonii Gray var. *reverchonii*
Hedyotis nigricans (Lam.) Fosb.
Hymenopappus scabiosaeus L'Her.
Juniperus virginiana L.
Krameria lanceolata Torr.
Lupinus subcarnosus Hook.
Lepidium virginicum L.
Lesquerella densiflora (Gray) S. Wats.
Lesquerella gracilis (Hook.) Wats. var. *gracilis*
Linum rigidum Pursh var. *berlandieri* (Hook.) T. & G.
Lygodesmia texana (T. & G.) Greene
Manfreda sp.
Marshallia caespitosa DC. var. *caespitosa*
Mentzelia oligosperma Sims
Morus sp.
Nothoscordum bivalve (L.) Britt.
Opuntia sp.
Pediomelum rhombifolium (T. & G.) Rydb.
Penstemon cobaea Nutt.
Polanisia dodecandra (L.) DC. subsp. *riograndensis* Iltis
Polygala alba Nutt.
Rhus aromatica Ait. var. *flabelliformis* Shinners
Rhus toxicodendron L.
Scutellaria drummondii Benth.
Solidago sp. (*canadensis* ?)
Tetraneuris linearifolia (Hook.) Greene
Thelesperma filifolium (Hook.) Gray
Triodanis perfoliata (L.) Nieuwl. var. *perfoliata*
Ulmus americana L.
Valerianella sp.
Verbena halei Small
Vicia minutiflora Dietr.
Vitis mustangensis Buckl.
Yucca sp.
Zanthoxylum sp.

Railroad, 2–3 miles northwest of Shreveport, Caddo Parish, LA. (Pennell 1921). The extreme differences in habitat and the morphological differences outlined above make it highly unlikely that the Grimes County population is conspecific with *A. caddoensis*.

HISTORY

Keeney (1967) listed *Agalinis aspera* (Benth.) Britton (as *Gerardia asper* Dougl. *ex* Benth. *in* DC.) as occurring on the outcrop. *A. aspera* is a narrow-leaved species which does not occur in Texas (but which is listed in the taxonomic references available to Keeney at that time.) Because the herbarium in which Keeney's specimens were deposited (SHST) was destroyed by fire in 1978, it is not known whether he saw locally common *A. heterophylla*, *A. navasotensis*, or both on the outcrop.

The earliest known specimen of *A. navasotensis* (dating from 1983) is the

misidentified Ajilvsgi specimen mentioned previously. Additional specimens were collected by the junior author from the type locality in the autumns of 1990, 1991, and 1992. An examination of herbarium sheets of *Agalinis* from SBSC and BRIT has revealed two more collections, both by Larry E. Brown from the type locality (*Brown 8065, 9613*). Collected in 1984 and 1985, respectively, these were originally identified as *A. gattingeri* (Small) Small.

In the fall of 1992, a second site was discovered. This second location is essentially the northern face of the same outcrop. Approximately 30 individuals were seen in flower growing with *Agalinis heterophylla* and *Euphorbia bicolor* on a badly eroded, sandy, rocky hillside in full sun. (VOUCHER: Texas. Grimes Co.: County Road 403, 0.5 mi N jct. FM 3090, NE of Navasota, 12 Sept 1992. *Dubrule 1046*). Because these plants are within approximately one mile of the main group at the type locality, they are well within bee-flight range for pollination purposes, and are therefore considered to be part of the same population. At the same time, another calcareous outcrop near St. Matthew's Parish in adjacent Washington county was surveyed for the presence of *A. navasotensis*, but was found to support only *A. heterophylla*.

THE FUTURE OF *AGALINIS NAVASOTENSIS*

Because *Agalinis navasotensis* is known from only one population of fewer than 300 individuals, it should be thought of as threatened, if not endangered. While the outcrop is on private land and there are no known plans to put the site into cultivation or to institute grazing, a widening of FM 3090 would probably mean the extirpation of the entire main subpopulation. The main site is not currently fenced or railed to protect it from foot or vehicular traffic.

The Oakville formation extends all the way to the southwestern corner of Duval County, and other outcrops are known along its length (Keeney 1967). It is possible, therefore, that other populations of this plant exist. It is the recommendation of the authors that any other outcrops on the formation be surveyed for the presence of *A. navasotensis*. Should many more individuals not be found, the species should be considered for inclusion on Federal and State endangered species lists.

ACKNOWLEDGMENTS

Thanks are due to Dr. Paul Fryxell for providing the Latin diagnosis and help in finding the second locality, to Scott Sweet and David Reed for help with field measurements, and to Dr. H.D. Wilson and Dr. J.R. Manhart for their encouragement and advice. Elizabeth A. Manrique provided the Spanish abstract. At the University of Guelph, Harold Siebert and Sharon Lackie are thanked for their expert technical assistance. Loans of *Agalinis* from ASTC, BRIT, LSU, NLU, and SBSC are gratefully acknowledged, as is the opportunity to examine the *Agalinis* at TEX.

APPENDIX 1.

Key to the narrow-leaved, long-pediceled species of Texas *Agalinis* and members of subsect. *Pedunculares*

1. Plants perennial, stiffly erect and multistemmed from a crown of lignescent taproots; plants of gypsum outcrops in Nuevo León, Mexico .... 1. *A. gypsophila* B.L. Turner
1. Plants annual, with a single main stem branched above; roots fibrous; plants of sandy soils in central and southeastern U.S.A 2
   2. Stems and leaves succulent and fleshy, often much branched near the base and with elongate racemes above; plants of salt marshes and coastal dunes ..... 2. *A. maritima* (Raf.) Raf.
2. Stems and leaves not succulent or fleshy; more uniformly branched along the main stem; plants of non-saline habitats 3
   3. Plants yellowish green, not tending to blacken on drying; corolla often drying pale pink to white, with a band of hairs within below the adaxial calyx lobes; seeds yellow and shallowly reticulate 4
      4. Leaves triangular-subulate to linear-subulate, heavily silicified, mostly less than 1 cm long; calyx lobes triangular-subulate, 0.4–0.6 mm long ..... 3. *A. oligophylla* Pennell
      4. Leaves linear, sparingly silicified, 1.5–3 cm long; calyx lobes triangular lanceolate, (0.5)1–2 mm long 5
         5. Corolla (10)12–20 mm long, broadly campanulate, the abaxial lobes pilose on the exterior surfaces; leaves spreading; capsule globose to globose-ovoid ..... 4. *A. gattingeri* (Small) Small
         5. Corolla 7–14 mm long, narrowly campanulate, the abaxial lobes glabrous; leaves erect-ascending; capsule obovoid .... 5. *A. viridis* (Small) Pennell
   3. Plants relatively dark green, often turning black on drying; corolla pink to rose-purple, pubescent within in a narrow longitudinal line below the sinus between the adaxial lobes or this absent; seeds brown and deeply reticulate 6
      6. Fruiting pedicels exceeded by subtending bracts; calyx lobes triangular-lanceolate to lanceolate; capsule 7–11 mm long, oblong to ovoid-oblong ..... 6. *A. aspera* (Benth.) Britton
      6. Fruiting pedicels nearly to greatly exceeding the subtending bracts; calyx lobes triangular, subulate to filiform-acuminate; capsule 4–8 mm long, globose to globose-ovoid (ovoid to ovoid or oblong in *A. navasotensis*) 7
         7. Axillary fascicles of short leafy shoots well-developed; stem ridges and sides conspicuously scabrous-scabrellous throughout 8
            8. Calyx and capsules glaucous; corolla lobes subequal, spreading-reflexed; leaves narrowly linear, acute ..... 7. *A. pulchella* Pennell
            8. Calyx and capsules without whitish bloom; adaxial corolla lobes shorter than abaxial lobes and projected flatly forward; leaves linear, acuminate ..... 8. *A. homalantha* Pennell
         7. Axillary fascicles absent or few and short; stem glabrous or nearly so 9
            9. Adaxial corolla lobes arched forward over style and stamens 10
               10. Corolla essentially glabrous externally except for small patches of hairs at sinuses of lobes; calyx tube greater than 3.5 mm long; anthers 3 mm long or longer ..... 9. *A. edwardsiana* Pennell
               10. Corolla throat pilose; calyx tube less than 3.5 mm long; anthers 2.5 mm long or shorter ..... 10. *A. tenuifolia* (Vahl) Raf.
            9. Adaxial corolla lobes spreading or reflexed 11

11. Largest leaves narrowly to broadly linear, flat; most pedicels conspicuously longer than the bracts; calyx ribbed along the major veins; corolla strongly upcurved 12
    12. Flowering pedicels generally less than 2 cm long, upcurved; calyx lobes with a minute silicified tip, the tube not silicified; leaves of short tertiary and quaternary branches conspicuously shorter than those of primary and large secondary branches; inflorescences often secund ..... 11. *A. strictifolia* (Benth.) Pennell
    12. Flowering pedicels 2 to more than 5 cm long, erect to spreading; calyx lobes heavily silicified, the tube often with silicified patches; leaves of higher order branches similar to those of primary and secondary branches; inflorescences not secund ..... 12. *A. peduncularis* (Benth.) Pennell
11. Largest leaves filiform, grooved on the upper surface; pedicels about equal to or slightly longer than the bracts; calyx not ribbed; corolla slightly upcurved 13
    13. Corolla 2 to 3 cm long, lobes subequal; calyx hemispheric-campanulate; inflorescence racemose; stigma white; plants of oak woods ..... 13. *A. caddoensis* Pennell
    13. Corolla 1.3 to 2.7 cm long, adaxial lobes slightly shorter; calyx obconic; inflorescence racemose-paniculate; stigma bright greenish-yellow; plants of sandstone outcrops ..... 14. *A. navasotensis* Dubrule & Canne-Hilliker

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